

Updates to the Known and Probable Karst Map of Ohio

By Donovan M. Powers and Dennis Hull

Ohio Geological Survey
2045 Morse Rd. Bldg C-1
Columbus, OH 43229-6693
Telephone: (614) 265-6591
Fax: (614) 447-1918
e-mail: donovan.powers@dnr.state.oh.us

INTRODUCTION

The data shown in this map were created to establish a comprehensive statewide coverage of the known and probable karst features in Ohio (Hull, 2006). They show the subsurface locations of karsts and karst terrain. The project was conceived to help facilitate the location of a low-level radioactive-waste disposal site. This investigation was initially funded through a grant administered by the Ohio Low-Level Radioactive Waste Disposal Facility Development Authority in 1997. The findings would be used to show the vulnerable karst areas and prompt the Development Authority to locate the waste disposal facility elsewhere. The primary source for the karst locations was the Ohio Cave Inventory provided by Dr. Horton H. Hobbs III of Wittenberg University. In addition, some investigation was conducted by utilizing geologic and soils maps as well as aerial photographs to find indications of karsts.

Thousands of sinkholes were inventoried but, for clarity, are not shown on the map. Field inspection of many indicated karst features allowed for documentation of more known karst locations and verified the mapping methods.

Probable karst areas were defined as those that: (1) lie within a half mile of a known or indicated karst location, and (2) are underlain by carbonate or gypsiferous bedrock with overburden generally of less than 20 feet of noncarbonate bedrock or unconsolidated material as shown by comparison of 7.5-minute bedrock-topography and bedrock-geology maps to surface topography. Known karst locations and probable karst areas on the work maps were digitized and are shown on this 1:500,000-scale map (Hull, 2006).

The map was updated by utilizing some of the datasets that the Ohio Division of Geological Survey has recently published as Geographic Information System (GIS) files. The criteria for carbonate or gypsiferous bedrock and for noncarbonate bedrock were queried out of the 2006 Bedrock Geology dataset, and like units were merged for simplification. The overburden of 20 feet or

less criteria was derived from the Drift-Thickness 2004 dataset. This raster dataset was generalized and reclassified into greater than or less than 20-foot units. These two sets of data were then combined and added to the map.

PROCESS

The Known and Probable Karst in Ohio Map has gone through three iterations since its creation in 1999. The first version was created via utilization of Cadastral software (Figure 1). The next version was converted to a GIS format by way of Environmental Systems Research Institute's (ESRI) ArcInfo Coverage format (Figure 2). This conversion was also accompanied with updates and additions to the dataset. In this third version, we use newly created data layers and a more graphically oriented software package, the result of which is a more illustrative product (Figure 3).

The latest version (Figure 4) incorporates data from three other products: Bedrock Geology, Drift Thickness, and the Glacial Margin extents from the Quaternary geology datasets. All of these layers were derived from sources within the Division of Geological Survey and are available as GIS datasets.

The incorporation of the bedrock geology units was a simple, straight-forward approach (Figure 5). The data are in a polygon vector format, so simply performing an attribute query on the bedrock units yielded those that meet the criteria conducive to karsting terrain.

The drift thickness data required a more extensive process (Figure 6). The data initially were in a raster format. For quality and illustrative purposes, the desired output needed to be vector. The process was to classify the raster into thickness of 20-feet or less and thickness over 20 feet. Next, the reclassified raster was converted to vector. This process caused stair stepping effect in the polygons and sporadic errors. A smoothing algorithm was used to better represent the areas. The smaller polygons were removed at a specific tolerance. The classified overburden layer was then merged with the carbonate or gypsiferous bedrock data. The dataset was closely

checked against the original source layers and found to be topologically correct. The most time consuming portion of this maps creation was the clean-up and editing process.

A final addition used for assistance in visualizing the pattern to karsting was the glacial margin lines that were adapted from the 1999 Quaternary Geology dataset (Pavey, 1999) (Figure 7). Adding more basemap data helped make the final map more cartographically appealing. The cities, road networks, and hydrography were derived from the Ohio Department of Transportation datasets.

REFERENCES

- Hull, D.N., 1999 (revised 2006), Known and probable karst in Ohio: Ohio Division of Geological Survey, Map EG-1 1999 (revised 2006).
- Pavey, R.R., Hull, D.N., Brockman, C.S., and others with GIS compilation by Powers, D.M., 1999 (revised 2006), Known and probable karst in Ohio: Ohio Division of Geological Survey, Map EG-1 1999 (revised 2006).
- Pavey, R. R., Goldthwait, R. P., Brockman, C. S., Hull, D. N., Swinford, E. M., and Van Horn, R. G., 1999, Quaternary geology of Ohio: Ohio Division of Geological Survey Map M-2, 1:500,000-scale map and 1:250,000-scale GIS files.

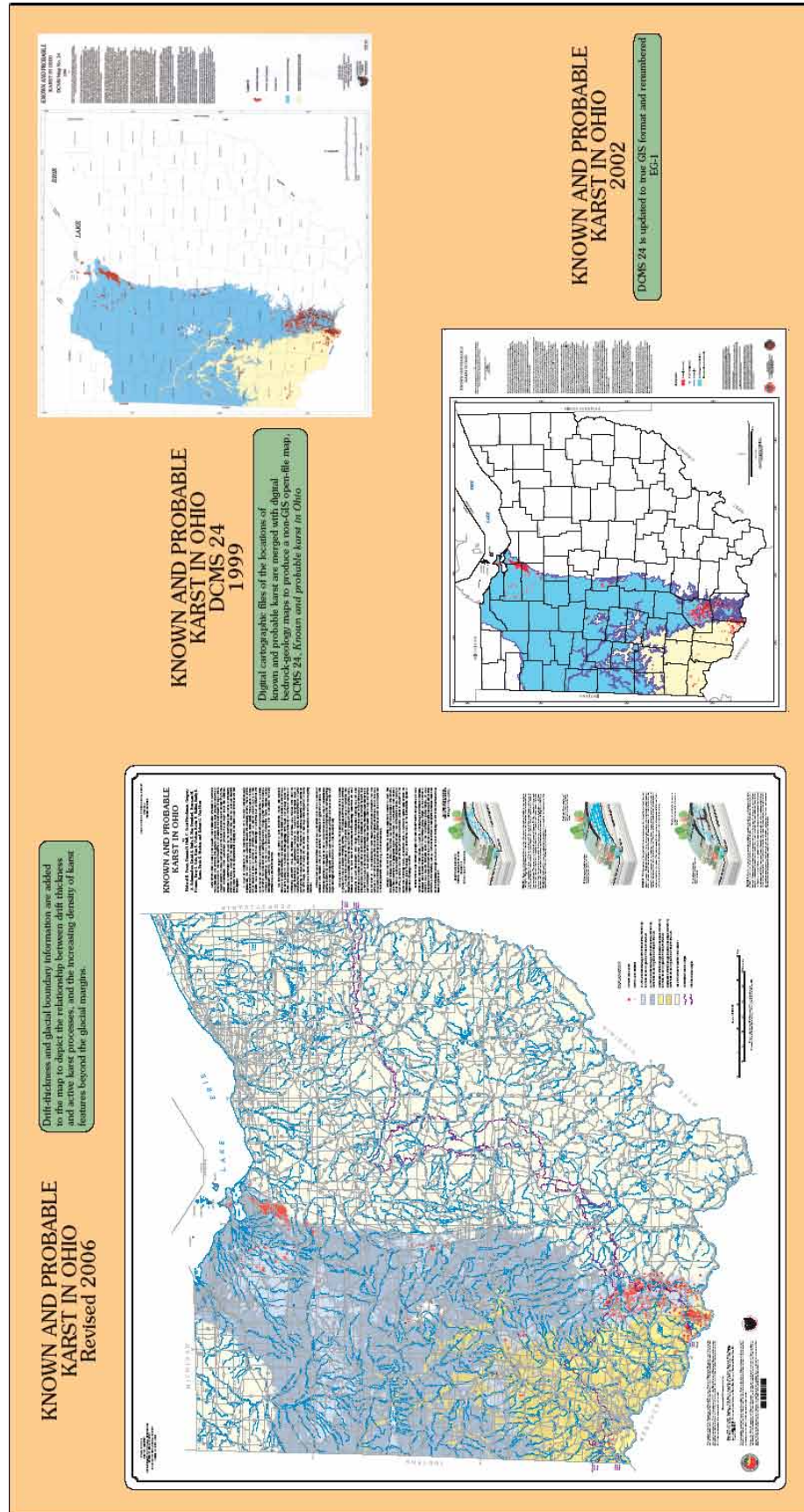


Figure 1. Poster of Known and Probable Karst in Ohio 2006 (as presented at the DMT meeting; see <http://ngmdb.usgs.gov/Info/dmt/docs/powers06.pdf>).

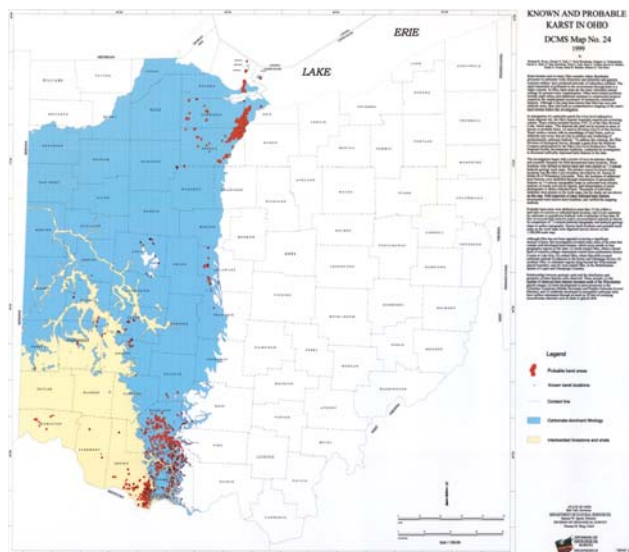


Figure 2. Version 1.0 (DCMS 24) of the Known and Probable Karst in Ohio, 1999.

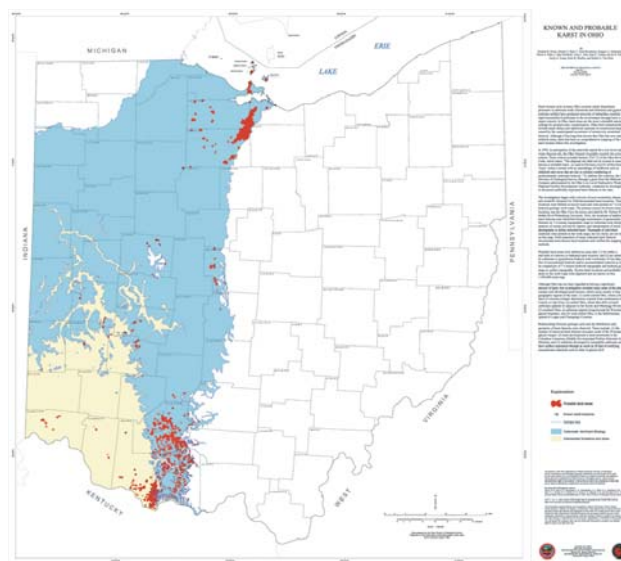


Figure 3. Version 2.0 of the Known and Probable Karst in Ohio, 2002.

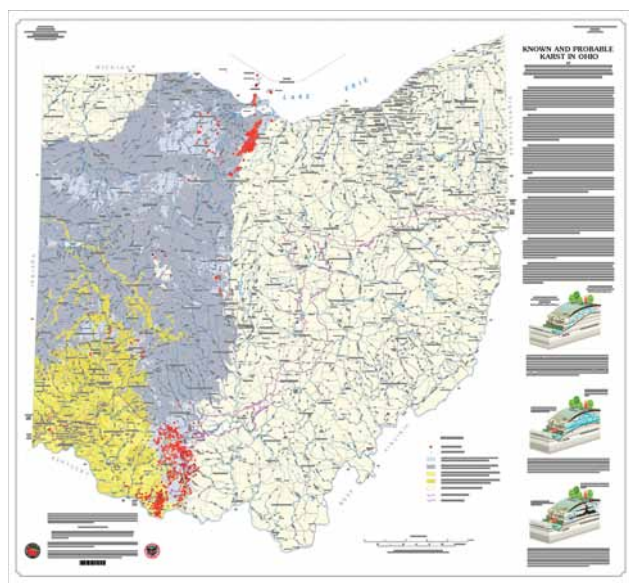


Figure 4. Version 3.0 of the Known and Probable Karst in Ohio, 2006.

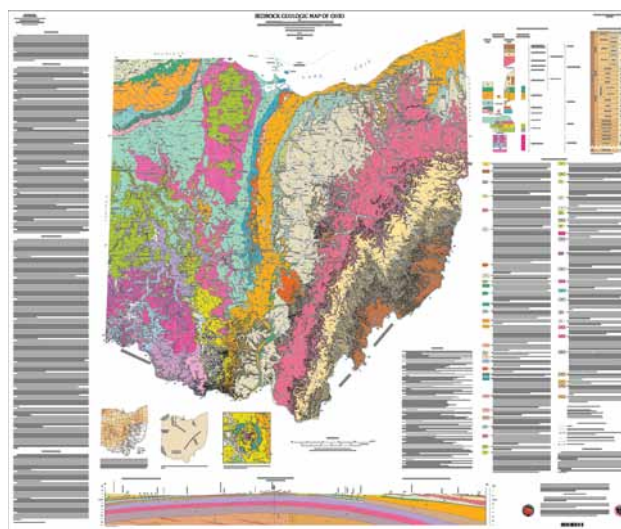


Figure 5. Bedrock Geologic Map of Ohio, 2006.

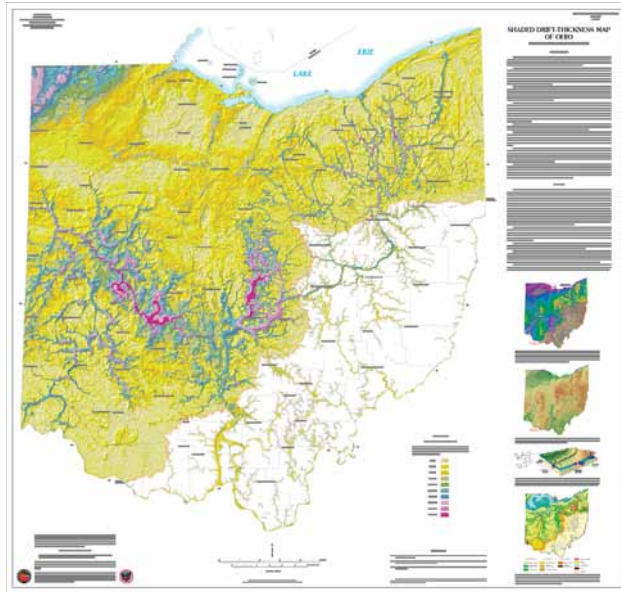


Figure 6. Shaded Drift Thickness Map of Ohio, 2004.

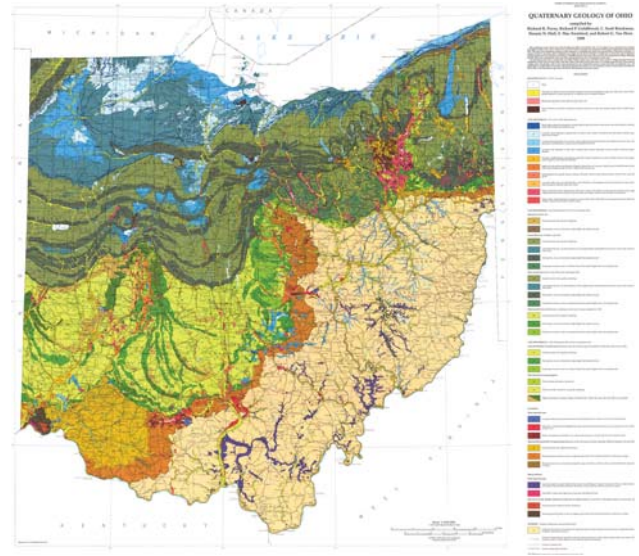


Figure 7. Quaternary Geology Map of Ohio, 1999.